

**ABSTRACT OF THE DISCLOSURE**

Methods and apparatus are provided for obtaining spatial information about an object, and for measuring the dielectric constant of an object. They include placing the object in a cavity and interacting electromagnetic radiation at a plurality of frequencies with the object to obtain a corresponding plurality of measured resonant transverse magnetic modes. They also include using the plurality of measured resonant transverse magnetic modes to obtain the spatial information for the object, and/or using the plurality of measured resonant transverse magnetic modes to obtain the dielectric constant for the object.